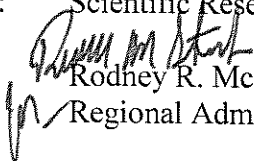




UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

September 26, 2008

MEMORANDUM FOR: Scientific Research Permit No. 1414
FROM:  Rodney R. McInnis
Regional Administrator
SUBJECT: Addendum to the Central Valley Programmatic Biological
Opinion for Scientific Research

I. CONSULTATION HISTORY

Section 10(a)(1)(A) of the Endangered Species Act of 1973, as amended, (ESA) provides NOAA's National Marine Fisheries Service (NMFS) with authority to grant exceptions to the ESA's "take" prohibitions for scientific research (see regulations at 50 CFR 222.301 through 222.308, and 50 CFR 224.101 through 224.102). Scientific research or enhancement permits may be issued to Federal or non-Federal entities conducting research or enhancement activities that involve take of ESA-listed endangered or threatened species. Any permitted research or enhancement activities must: (1) be applied for in good faith; (2) if granted and exercised, not operate to the disadvantage of the listed species; and, (3) be consistent with the purposes and policy set forth in section 2 of the ESA (50 CFR 222.303(f)). NMFS prepared this addendum to the Central Valley Programmatic Biological Opinion for Scientific Research (Central Valley Research Opinion; NMFS 2003), signed on September 5, 2003, in compliance with section 7(a)(2) of the ESA, as amended (16 U.S.C. 1536).

The East Bay Municipal Utility District (EBMUD) originally submitted a section 10(a)(1)(A) application to NMFS on May 13, 1998, for the Lower Mokelumne River Fisheries Monitoring Program (LMRFMP), and submitted a revised application on January 9, 2003. NMFS issued Permit No. 1414 (Permit 1414) to EBMUD on March 31, 2004, effective through June 30, 2008 (69 FR 40626).

EBMUD submitted a section 10 (a)(1)(A) application to NMFS on May 6, 2008, and resubmitted updated applications on May 22, 2008, and September 19, 2008, for the renewal of Permit 1414.

NMFS published a notice of receipt of EBMUD's permit application in the Federal Register on June 27, 2008 (73 FR 36494), announcing the beginning of a thirty-day public comment period. No public comments were received.



II. DESCRIPTION OF THE PROPOSED ACTION

Under the authority of section 10(a)(1)(A) of the ESA, NMFS proposes to re-issue Scientific Research Permit 1414 as Permit 1414-Modification 1 (M1) to EBMUD, authorizing take of Central Valley (CV) steelhead. The permit would be in effect through June 30, 2013, and would be subject to the limitations of the ESA and the regulations in 50 CFR parts 222,223, and 224, for the period stated on the permit unless it is modified, suspended, or revoked sooner. The Lower Mokelumne River Fisheries Monitoring Program (LMRFMP) is in support of the Federal Energy Regulatory Commission (FERC) license proceeding on the Lower Mokelumne River Project (FERC Project No. 2916-004). Its objectives involve obtaining scientific data on anadromous fish, resident fish, and fish habitat on the lower Mokelumne River as part of an ongoing process to measure the success of the flow requirements and non-flow measures set forth in the 1998 Joint Settlement Agreement (JSA) between EBMUD, the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG). The JSA goals include the provision of habitat quality and availability to maintain fishery, wildlife and riparian resources; contributing to state and federal fishery restoration goals; and sustaining long-term viability of the salmon and steelhead fishery while protecting the genetic diversity of natural populations in the lower Mokelumne River. Microchemistry analysis on collected *Oncorhynchus mykiss* otoliths will be used to develop and implement Hatchery and Genetics Management Plans (HGMPs) for the MRH steelhead (*Oncorhynchus mykiss*) and fall-run Chinook salmon (*O. tshawytscha*) programs.

EBMUD provides its scientific data to the Central Valley Project Improvement Act (CVPIA) Comprehensive Assessment and Monitoring Program (CAMP) to evaluate the relative effectiveness of CVPIA actions in restoring anadromous fish production. EBMUD also provides quarterly updates of data collection to the Bay Delta Tributaries (BDAT) Project site, a database for environmental data concerning the San Francisco Bay-Delta. The collection of scientific data is necessary to meet EBMUD's FERC and CAMP obligations and commitments and will require the take of Federally-listed steelhead in the lower Mokelumne River. The LMRFMP is expected to be continued indefinitely.

A. Monitoring Activities

The LMRFMP sampling sites are located within six river reaches (Figure 1), starting in the San Joaquin-Sacramento Delta and ending at Camanche Dam:

- reach 1 – upstream from the confluence of the San Joaquin River to the confluence of the Cosumnes River (34.96 miles)
- reach 2 – the confluence of the Cosumnes river upstream to Woodbridge Dam (15.18 miles)
- reach 3 – Woodbridge Dam upstream to the Highway 99 Bridge (4.10 miles)
- reach 4 – High way 99 Bridge upstream to Elliott Road Bridge (10.68 miles)
- reach 5 – Elliott road Bridge upstream to the Mackville road Bridge (5.41 miles)
- reach 6 – Mackville Road Bridge upstream to Camanche Dam (4.83 miles)

In addition to the river reach samples, data on upstream and downstream fish passage were collected at Woodbridge Dam through 2005.

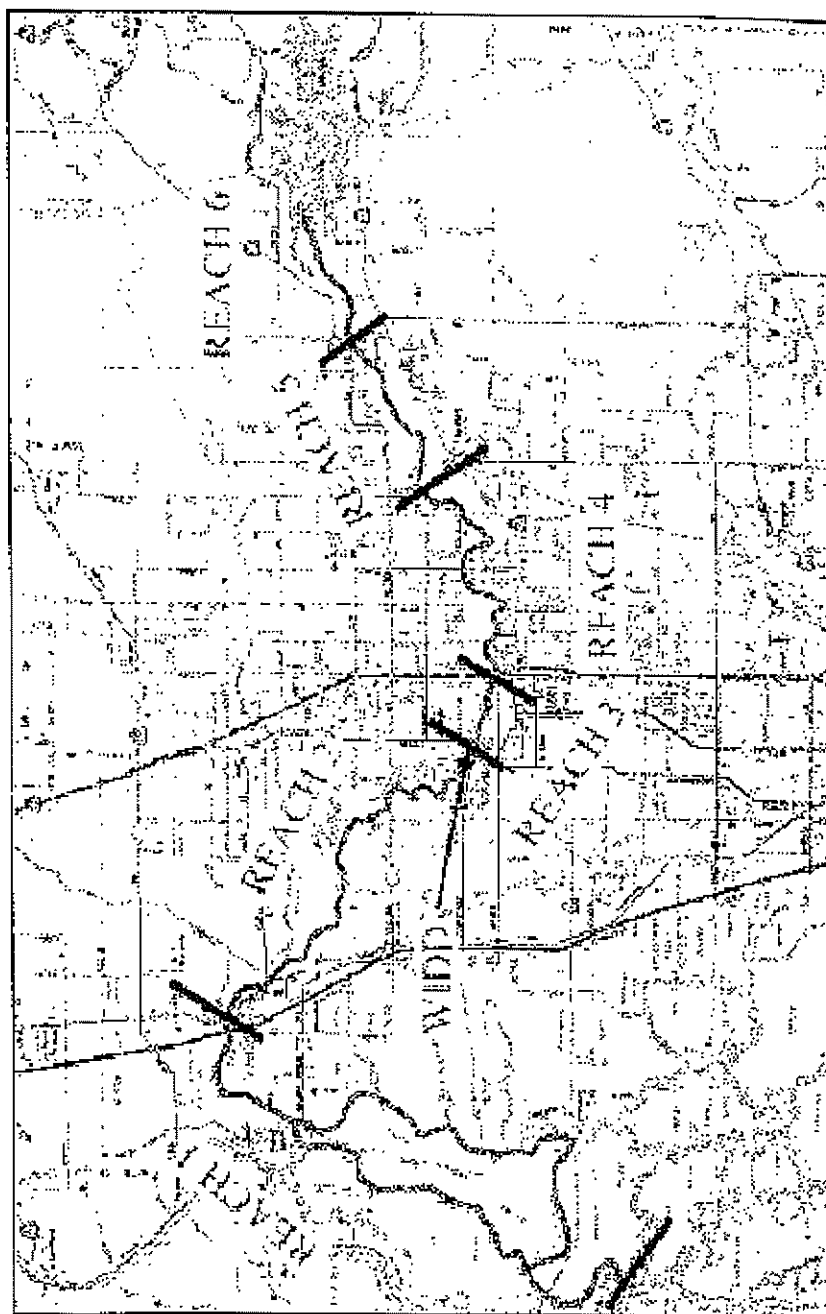


Figure 1. Sampling locations in the lower Mokelumne River.

1. Upstream Migration

The objective is to measure the number, sex, size and timing of upstream migrating anadromous fish in the lower Mokelumne River, year-round. Methodologies include:

- video monitoring the upmigration of fall-run Chinook salmon, steelhead-trout, and other anadromous species moving past Woodbridge Dam in the upper and lower stage fish ladders;
- trapping, measuring, tagging (Peterson disc, Passive Integrated Transponder (PIT-tag), or internal acoustic tag), and releasing a subsample (not to exceed 30 percent of the run or 500 Chinook salmon and 100 steelhead-trout, whichever is less) of the population of the upmigrating adult and jack Chinook salmon and steelhead returning to the lower Mokelumne River; and,
- conducting a carcass survey beginning the first week in October and extending through the first week in January; up to 100 steelhead carcasses will be collected and retained for biological tissue sampling.

2. Downstream Migration

The objective is to measure the number, size and timing of outmigrating anadromous fish in the lower Mokelumne River, from December 1 through July 31. Methodologies include:

- placement and operation of a rotary screw trap at RKM 63 below Woodbridge Dam and at RKM 90 upstream of Elliott road in Lockeford. All fish captured are counted, identified, weighed, and measured prior to their release. As many as 200,000 fall-run Chinook salmon and 2,000 steelhead-trout may be captured and released.
- operation of a salmon smolt bypass trap installed in the fish bypass pipe adjacent to the Woodbridge Irrigation District (WID) irrigation canal; during periods of active irrigation, fish are screened to a bypass pipe with an inline trap that is accessed and monitored daily. Lengths, weights, any external markers (fin clips, tags, brands, and other anomalies) and species of all captured fish will be recorded. As many as 10,000 Chinook salmon smolts and 1,000 steelhead may be captured and released.
- coded-wire tagging (CWT) approximately 5 percent of projected outmigration, not to exceed 100,000 fish, of the fall-run Chinook salmon fry and smolts captured, prior to their release; tagging will cease if mortality exceeds 1.0 percent. A representative sample of fish will be held in a live car to test survival and tag retention at the vicinity of the release location.

3. Redd Surveys

To measure the reproductive effort of CV steelhead, redd surveys will be conducted weekly between September 1 and April 30, depending on timing of their upstream migration. Spawning areas will be surveyed from the Fish Guidance Fence below Camanche Dam (river kilometer [RKM 103]) downstream to Woodbridge Dam (RKM 90) by boat. Fish redds will be

enumerated and marked (*i.e.*, with colored, numbered bricks or tags), and their location will be recorded in a Geographic Information System (GIS) database.

4. Fish Population Surveys

The objective is to determine reproductive success, growth rates, and survival rates of anadromous fish; population composition and structure of resident fishes in the Lower Mokelumne River. Fish may be enumerated, measured, weighed, and marked. Methodologies include:

- seining and backpack electrofishing; fyke traps – every other week from December 1 (or when salmon egg-model predicts emergence and sampling period) through June 30, and monthly from July through November. A 50-foot by 6-foot (1/16-inch mesh) beach seine or back-pack electrofishing unit is used to collect fish during daylight. Two fyke traps will be run for a 24-hour period during the study. All fish species (up to 50 individuals of a species) will be measured and weighed. After enumeration, all fish will be released immediately at the sample site. Tricaine methanesulfonate (MS-222) may be used on captured fish if accurate weights and measurements cannot be obtained without it. A fraction of the collected juvenile fall-run Chinook salmon and steelhead may be marked using photonic dye, pit tags, CWTs, acoustic tags, or floy tags, to track individual fish. Tracking of marked fish will be accomplished with bi-monthly seining surveys and two rotary screw traps operated below Woodbridge Dam. A maximum of 20,000 juvenile Chinook salmon and 500 steelhead will be tagged. Tagging operations will cease if mortality exceeds 1.0 percent.
- boat electrofishing (Smith-Root boat) will be conducted during a three-day period quarterly throughout the year; all fish captured will be released immediately at the sample site. A fraction of the captured fall-run Chinook salmon and steelhead captured may be marked using photonic dye, pit tags, CWTs, acoustic tags, or floy tags, or Peterson Disc tags to track individual fish. Tracking of marked fish will be accomplished in subsequent electrofishing surveys or upon entry to the MRH. A maximum of 1,000 juvenile Chinook salmon and 500 steelhead will be tagged. Tagging operations will cease if mortality exceeds 1.0 percent.

5. Fish Diet Evaluation

The objective is to describe the diet of the fish community in the lower Mokelumne River. EBMUD plans to perform gastric lavage on a fraction of adult CV steelhead and juvenile CV steelhead captured at the Woodbridge Dam ladders, trapped by RST, or from seining or electrofishing. Gastric lavage will be conducted on up to 25 steelhead with a total length (TL) less than 50 millimeters (mm), 25 steelhead between 50 and 200 mm TL, and 25 steelhead greater than 200 mm TL. Resulting data will allow the diet of CV steelhead to be evaluated and described for the Lower Mokelumne River.

6. Evaluation of Anadromous Fish Predation below Woodbridge Dam

The objective is to determine the rate of juvenile anadromous fish predation below Woodbridge Dam. Methodologies include electrofishing, beach seining, trawling, and hook and line collection of striped bass (*Morone saxatilis*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*) and Sacramento pikeminnow (*Ptychocheilus grandis*) in the lower Mokelumne River below Woodbridge Dam. Up to 200 predatory fish will be collected below Woodbridge Dam to perform gastric lavage and identify stomach contents. Fish will be released after collection. Collections will be made from January through July.

7. Otolith Microchemistry Evaluation

The objective is to determine maternal origin and life history of hatchery and wild *O. mykiss* on the lower Mokelumne River as supporting data for a MRH steelhead HGMP. Methodologies for the collection of 100 adult wild, 100 adult hatchery, and 100 in-river fish (50 smolt and 50 age-0), include: electrofishing, beach seining, rotary screw trap operations, and collections within the hatchery. Collections will be made for adults in the winter, for smolts in the winter and spring, and for age-0 in the fall when they are largest. Otolith strontium:calcium (Sr/Ca) and $^{87}\text{Sr}/^{86}\text{Sr}$ ratios will be measured in the core and along a transect from the core to edge “using inductively coupled plasma mass spectrometry” (ICPMS) and wavelength dispersive electron microprobe. The age of each fish will be estimated from the banding pattern in the otolith. These analyses will provide the necessary data to: (1) estimate the proportions of anadromous and non-anadromous adults (life history form) in the river and hatchery; (2) estimate the proportion of adults in the two populations that are the progeny of anadromous and non-anadromous females; (3) estimate the proportion of adults from both forms that are progeny of the opposite maternal life history form; (4) estimate the size and age at ocean entry and number and age at each freshwater/marine migration; and (5) estimate the proportion of adults that did not rear in the Mokelumne River as juveniles and assign them to rearing stream; and (6) estimate the proportion of non-anadromous adults that moved in and out of the Mokelumne River and identify potential rearing habitats.

Adult steelhead will be collected from the river and the hatchery in the winter season. Sample groups will be stratified based on their size, with 550 mm FL as the end point. Adults will be sampled across their known distribution in the river; hatchery adults will be sampled across the hatchery spawning season in proportion to their seasonal abundance in arrival.

Otoliths will be extracted, cleaned of adhering tissue, rinsed, and stored in vials for later analysis. Scales (ocean entry/age), fin clips (genetic analysis) and muscle tissues (isotopic analyses) will be collected as well. The otoliths analysis will be carried out by research staff at the University of California, Santa Cruz.

8. Tissue Collection

Collections of *O. mykiss* tissues in the lower Mokelumne River by EBMUD will be under the direction of CDFG and in coordination with CDFG’s tissue collection efforts in the upper Mokelumne River (G. Edwards, CDFG, pers. comm.). Tissues will be analyzed to assess the *O.*

mykiss genome(s) present in the upper and lower Mokelumne River, and supplement information for the Central Valley *O. mykiss* population genetics inventory being conducted by CDFG. Prior to making collections, specific tissue excision methods and arrangements for tissue preservation and transfer to CDFG's Central Valley Genetics Archive will be coordinated with and approved by Mr. Rob Titus, CDFG, Inland Fisheries Division, P.O. Box 944209, Sacramento, CA 94244-2090.

Monitoring and Marking Methodologies

The LMRFMP will employ the following marking and monitoring strategies, as appropriate:

handling: captured fish are transferred from the traps, seines, nets or electrofishing with dip nets to 20-liter buckets or live cars filled with fresh river water to which 30 to 50 milligrams per liter (mg/l) of MS-222 may be added for rapid and short-term induction of a moderate level of sedation for most of the species captured. Up to 50 of each salmonid species captured during each capture will be randomly measured and weighed. After counting and measuring, fish will be gently placed in a 20-liter bucket of fresh river water or in a live car with a flow-through tank with pumped-in-river water to recover from sedation before being released downstream from the traps, seines or nets. Total processing time for individual fish from sedation and measurement to recovery and release is generally 5 to 30 minutes. To ensure DO₂ remains at sufficient levels in holding buckets or live cars, water will be exchanged every 5 to 10 minutes or supplemental oxygen will be supplied. Handling will be minimized below current levels, and no tagging or marking will be conducted when captured fish show signs of previous stress (*e.g.*, predator wounds, fungal infections, abrasions, bacterial infections, *etc.*)

tagging: all fish tagging or marking will be coordinated with the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and NMFS biologists responsible for statewide or regionwide coordination. Fish will be anesthetized during tagging to minimize handling stress and handling time, and oxygen may be applied. Tagging equipment, hands and gloves will be disinfected with Betadine solution (approximately 5 minutes) and rinsed with physiological saline before handling fish to reduce stress and infection. Anesthetic water will be treated with Polyqua, salt, and ice; recovery water will include the same.

disc tagging: numbered and color-coded 35 mm Peterson disc tags will be used to identify individual steelhead. Discs will be attached to muscular tissue on the leading edge of the dorsal fin with a 25 mm T-bar anchor pushed through the hold at the top of the tag and then through the fin with a Dennison Mark IITM Pistol L tagging gun (Floy Tag & MFG., Incorporated [Inc.]). A 25 mm backing plate will be used to prevent the T-bar from pulling back through the fin tissue. After tagging, fish will be immediately released and observed for 30 minutes.

coded-wire tagging: juvenile salmonids will be marked CWT by injecting 0.5 mm binary CWTs into their head cartilage using a Northwest Marine Technologies Mark IV tagging machine and marked by excision of the adipose fin. After tagging, fish will be passed through a filed microtag detector to ensure tag implantation and placed in a 20-liter bucket filled with fresh river water and released within 100 meters of capture.

photonic tagging: juvenile salmonids marked with Latex will be anesthetized using MS-222. Fish are weighed and measured. Liquitex brand medium viscosity acrylic paint is injected subdermally at the base of the pectoral, pelvic, and caudal fins using a 3cc 25 gauge Becton Dickinson hypodermic needle. The needle insertion is approximately 2 to 3 mm, and paint is injected as the needle is withdrawn to create a line of paint visible beneath the skin. Fish are then recovered in oxygenated water and released.

passive integrated transponder tagging: PIT tagging will be used to mark adult (>250 mm) and juvenile (<55 mm) salmonids. All PIT tagging will be conducted following the procedures outlined by Biomark, Inc. (20 South Cole, Boise, Idaho 83709) and the methods described by Prentice *et al.* (1990).

acoustic tagging: fish >200 mm TL will be anesthetized and placed on a foam-lined measuring board. Oxygenated water is pumped through a tube directly to gills during surgery. A ¾ inch incision is made just anterior of the pelvic girdle insertion and just off the midline. The acoustic tag is then placed inside the incision and the incision is closed using 2 to 3 stitches or 2 to 3 surgical staples. Surgery time will not exceed 2 minutes.

drug administration: MS-222 will be administered according to the manufacturers' recommendations and the protocols suggested by Schreck and Moyle (1990). When practical, carbon dioxide (CO₂) will be used to anesthetize fish in place of MS-222.

release: all fish are released immediately after processing (counting, weighing, measuring, and tagging) within 100 meters of the capture site.

B. Action Area

The action area is defined as "... all areas to be affected directly or indirectly by the Federal action area and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this consultation includes all portions of the Lower Mokelumne River from Camanche Dam to the San Joaquin River confluence.

C. Requested Amount of Take

The Endangered Species Act defines "take" as "... to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct; may include significant habitat modification or degradation if it kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. EBMUD has requested nonlethal annual take authorization for 600 adults, 3,000 young-of-the-year (YOY), and 3,000 smolt CV steelhead; lethal annual take authorization for 10 adults, 50 YOY fish, and 50 smolts; and take authorization for 200 steelhead carcasses (see Table 1). EBMUD also will observe another 500 adult *O. mykiss* in river during the research period. In addition, EBMUD has requested a one-time lethal take authorization for CV steelhead, comprised of 100 hatchery and 100 wild steelhead adults, 50 YOY, and 50 smolts, for a microchemistry analysis of *O. mykiss* otoliths (Table 2). Requested take includes both hatchery and wild fish, although Mokelumne River Hatchery (MRH) steelhead stock are not part of the CV steelhead Distinct Population Segment (DPS) (71 FR 834).

D. Measures to Reduce the Impacts of the Study

Following are measures implemented to minimize any adverse impacts on these salmonids during the research activities:

1. NMFS has reviewed the credentials of the principal investigators for the proposed research. All investigators are qualified and have provided evidence of experience working with salmonids or the concepts outlined in the proposed projects.
2. NMFS has developed nondiscretionary conditions for Permit 1414-M1 necessary and appropriate to minimize take of listed salmonids, as described in the permit and Appendices A and B of the Central Valley Research Opinion. The investigators will ensure that all persons operating under Permit 1414-M1 will be familiar with the terms and conditions therein.
3. NMFS will monitor project activities to ensure that the project is operating satisfactorily in accordance with Permit 1414-M1. NMFS will monitor actual annual take of ESA-listed fish species associated with the proposed research activities (as provided in annual reports or by other means) and will adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the salmonids.
4. All persons operating under Permit 1414-M1 will be properly trained and have access to properly maintained state-of-the-art equipment.
5. All salmonids captured and not lethally taken will be processed immediately, allowed appropriate time to recover, and then released.

Table 1. Anticipated Annual Take for Lower Mokelumne River Fish Monitoring Program

Species	Life Stage	Origin	Take Activity	Number of Fish Requested	Requested Unintentional Mortality	Research Location	Research Period
Central Valley Steelhead DPS	Adult	Naturally produced/artificially propagated	Observe	500	0	Lower Mokelumne River	Year round
Central Valley Steelhead DPS	Adult	Naturally produced/artificially propagated	Capture, measure, weigh and release	400	0	Lower Mokelumne River	Year round

Central Valley Steelhead DPS	Adult	Naturally produced/ artificially propagated	Tag, Fin Clip, or Taking Tissue	200	10	Lower Mokelumne River	Year round
Central Valley Steelhead DPS	Young of Year	Naturally produced/ artificially propagated	Capture, measure, weigh and release	2,000	0	Lower Mokelumne River	Year round
Central Valley Steelhead DPS	Young of Year	Naturally produced/ artificially propagated	Tag, Fin Clip, or Taking Tissue	1,000	50	Lower Mokelumne River	Year round
Central Valley Steelhead DPS	Smolt	Naturally produced/ artificially propagated	Capture, measure, weigh and release	2,000	0	Lower Mokelumne River	Year round
Central Valley Steelhead DPS	Smolt	Naturally produced/ artificially propagated	Tag, Fin Clip, or Taking Tissue	1,000	50	Lower Mokelumne River	Year round
Central Valley Steelhead DPS	Carcass (dead)	Naturally produced/ artificially propagated	Tag, Fin Clip, or Taking Tissue	200	0	Lower Mokelumne River	Year round

Table 2. Anticipated Annual Take for the Otolith Microchemistry Task

Species	Life Stage	Origin	Take Activity	Number of Fish Requested	Requested Intentional Mortality	Research Location	Research Period
Central Valley Steelhead DPS	Adult	Naturally produced/ artificially propagated	Collection for otolith microchemistry	200	200	Lower Mokelumne River	Winter
Central Valley Steelhead DPS	Smolt	Naturally produced	Collection for otolith microchemistry	50	50	Lower Mokelumne River	Winter and Spring
Central Valley Steelhead DPS	Age-0	Naturally produced	Collection for otolith microchemistry	50	50	Lower Mokelumne River	Fall

Monitoring Results, 2004 – 2008

(Workman 2005, 2006a, 2006b; Workman and Rible 2007; Workman *et al.* 2007)

Acoustic Tagging of wild and hatchery *O. mykiss*

A California Urban Water Agencies (CUWA) funded study was initiated in 2007 to evaluate movement and habitat use of hatchery produced and naturally spawned *O. mykiss* in the lower Mokelumne River. Preliminary results to date indicate that most (85 percent) of the *O. mykiss*

captured, tagged, and released in the lower Mokelumne River remained in the river above the Highway 99 Bridge. This suggests that a large proportion of the Mokelumne River *O. mykiss* population, and MRH steelhead, may be responding to environmental cues and expressing a nonanadromous life history.

Pit tagging of wild *O. mykiss*

Preliminary data analysis has been conducted on the PIT tagged steelhead through January 2006. Data were analyzed using the POPAN5 Jolly-Dickson full model described by Arnason *et al.* (1998). Preliminary results indicated a population of 9,215 (plus or minus \pm 1,877) steelhead in the lower Mokelumne River (natural origin, 100 mm FL or greater).

Migration Assessment

An annual assessment of outmigrating young-of-year *O. mykiss* is developed utilizing hatchery Chinook trap efficiency trials. In 2001, paired efficiency trials to assess the utility of this assessment. Chi square analysis of these paired releases showed no significant difference in recapture rates between the two groups. Calibrated estimates of young-of-year steelhead have ranged from 736 steelhead in 2004 to 9,750 in 2006.

The 2004-2005 upstream migration assessment, based on video monitoring at Woodbridge Dam, counted 44 adult steelhead between October 2004 and February 2005, peaking in November. The ratio of hatchery to wild steelhead was 3:1 (33 adipose fin-clipped to 11 nonclipped). In addition, 13 steelhead passed downstream of Woodbridge Dam between December 2004 and March 2005. During the 2004 to 2008 permit period, no *O. mykiss* were detected in spawning ground carcass surveys.

Other Research and Monitoring in the Mokelumne River

Several studies have been carried out during the past 4 years which have contributed to the knowledge of *O. mykiss* in the Mokelumne River watershed.

Acoustic tag study

Preliminary results from an acoustic tagging study of wild and hatchery *O. mykiss* indicate that a significant proportion of the river population is resident, as 85 percent of the natural *O. mykiss* captured, tagged, and released in the lower Mokelumne River remained in the river above the Highway 99 Bridge. Participants in the study include EBMUD, UC-Davis, and UC-Santa Cruz. The study is funded by CUWA.

Preliminary results from a steelhead pit-tagging study carried out through January 2006 indicated a population of 9,215 \pm 1,877 steelhead in the lower Mokelumne River from Camanche Dam downstream to Woodbridge Dam, using a mark-recapture study with PIT tags (EBMUD *et al.*

2008). Annual juvenile out-migration assessments, based on mark-recapture activities, have ranged from 736 steelhead in 2004 to 9,750 in 2006.

Additional research studies being carried out in the Mokelumne River are:

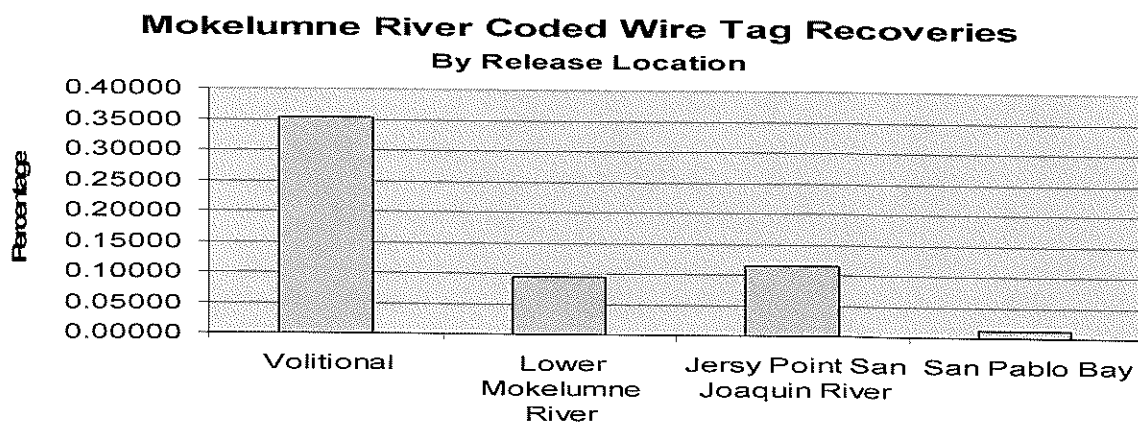
- (1) an investigation on the movement of wild age 1+ *O. mykiss* from rotary screw trap captures, initiated in January 2008 by Dr. Joseph E. Merz of Cramer Fish Sciences,
- (2) an investigation into the dynamics of habitat features, streamflow and depth affecting instream macro-invertebrate and fish community structure, and how each of these affect the growth, movement and survival of juvenile steelhead, by Walter Heady, University of California, Santa Cruz (UC-Santa Cruz), Ph.D candidate, in collaboration with the NMFS Southwest Fisheries Service and EBMUD, and
- (3) an investigation of the timing of emigrating of juvenile *O. mykiss* and the role of environment, particularly water flow, in shaping life history strategy, a collaborative effort by CDFG, NMFS Southwest Fisheries Science Center (SWFSC) and UC-Santa Cruz.

Coded-wire tag hatchery releases

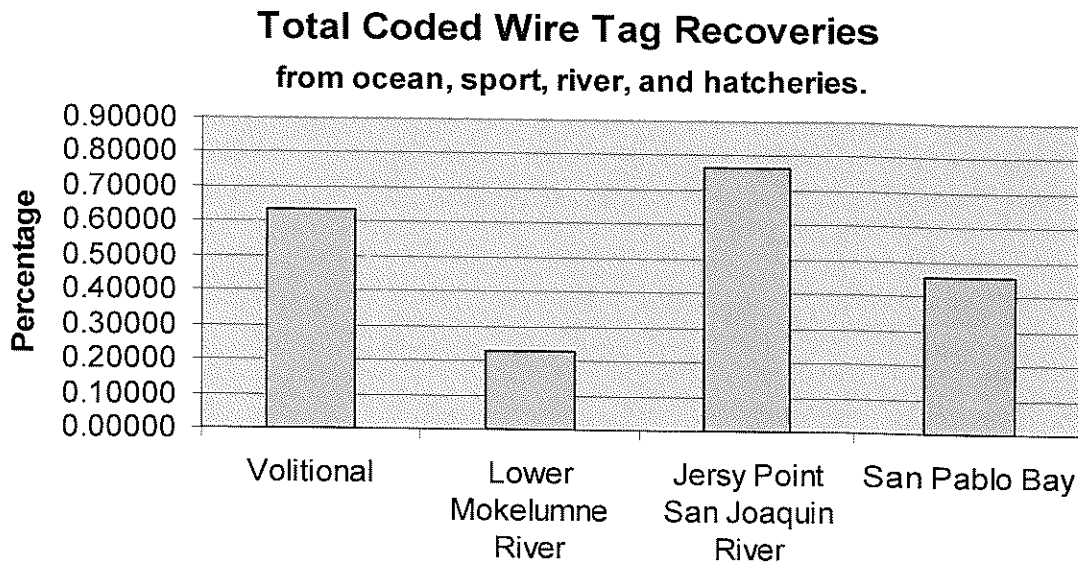
MRH has released CWT steelhead smolts, broodyears 2003 through 2007, in an effort to track the migration of hatchery steelhead from four different release sites. Releases locations included volitional in-river, at New Hope Landing in Thornton, and in San Pablo Bay at Antioch. Released steelhead are progeny of both MRH and Feather River Hatchery supplemental broodstock, and allowed for additional analysis between fish stocks.

Preliminary results indicate that the highest returns to the Mokelumne River system came from volitional releases at the MRH (Graph 1). The volitional release strategy also provided a significant number of escapement for harvest, second only to harvested escapement from Jersey Point releases (Graph 2).

Graph 1.



Graph 2.



Mokelumne River Recoveries	
Location	Percentage
Volitional	0.35264
Lower Mokelumne River	0.09330
Jersey Point San Joaquin River	0.114280
San Pablo Bay	0.011300
Total Recoveries	
Location	Percentage
Volitional	0.63211
Lower Mokelumne River	0.22846
Jersey Point San Joaquin River	0.764320
San Pablo Bay	0.45571

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

CV steelhead were federally-listed as a threatened species on March 19, 1998 (63 FR 13347). NMFS had concluded that CV steelhead was in danger of extinction because of habitat degradation and destruction, blockage of freshwater habitats, water allocation problems, genetic introgression resulting from widespread production of hatchery steelhead and the ecological interaction between introduced stocks and native stocks. The current status of CV steelhead has not significantly improved, based on NMFS' 2005 evaluation of the CV steelhead DPS risk of extinction (71 FR 834). CV steelhead have declined from an approximate average of 11,000 adult fish in the late 1960s and 1970s, to an estimated 2,000 fish through the early 1990s (McEwan 2001). Recent estimates (1998 through 2000) from trawling data in the San Francisco-San Joaquin Delta suggests that an annual average of 181,000 wild juveniles are produced

(NMFS 2004). The ratio of wild versus hatchery-produced fish averaged 0.148 in 2003. All hatchery steelhead in California are adipose fin-clipped, but as they do not receive CWTs, it is not possible to compare return rates for CV steelhead hatchery programs. However, escapement numbers are distinguished for hatchery and natural-spawned steelhead. Starting in 2001, resource managers have carried out steelhead monitoring efforts in the American and Feather rivers to provide population estimates. Additional information on CV steelhead is also collected at weirs located in Battle Creek and Clear Creek, and the Stanislaus and Yuba rivers. In order to gather reliable estimates of steelhead abundance for different basins throughout the Central Valley, CDFG, in partnership with Pacific States Marine Fisheries Commission (PSMFC), is collaborating with the California Department of Water Resources (CDWR), East Bay Municipal Utility District (EBMUD), and the U.S. Fish and Wildlife Service (USFWS), to develop a standardized, statistically-valid steelhead monitoring methodology for the Central Valley (Alice Low, CDFG, pers. comm.).

Critical habitat is comprised of physical and biological features essential to the conservation of the species, including: space for individual and population growth and for normal behavior; cover; sites for breeding, reproduction and rearing of offspring; and habitats protected from disturbance or are representative of the historical geographical and ecological distribution of the species. Critical habitat was designated for CV steelhead on February 16, 2000 (65 FR 7764), and re-designated on September 2, 2005 (70 FR 52488). Designated critical habitat for CV steelhead includes the lower Mokelumne River, from its mouth to Camanche Dam.

The physical parameters of critical habitat include the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation (70 FR 52488). The bankfull elevation is defined as the level at which water begins to leave the channel and move into the floodplain; it is reached at a discharge that generally has a recurrence interval of 1 to 2 years on the annual flood series (Dunne and Leopold 1978, MacDonald et al. 1991, Rosgen 1996).

Factors affecting CV steelhead and habitat include: 1) dam construction; 2) water management and development activities; 3) land use activities such as agriculture, flood control, urban development, mining, and logging; 4) hatchery operation and practices; 5) harvest activities; 6) ecosystem restoration actions; 7) natural conditions; and 8) scientific research. Large dams are present on almost every major tributary to the Sacramento River, the San Joaquin River, and in the Sacramento-San Joaquin Delta, and block steelhead access to the upper portions of watersheds that represent approximately 80 percent of historical habitat. As more than 95 percent of historic spawning habitat is inaccessible and steelhead require cooler water at higher elevations, NMFS' recovery priority for the CV steelhead DPS is passage above dams. Water diversions directly entrain fish, and can affect habitat by reducing wetted area and causing water temperatures to increase. Runoff from agricultural, urban, and other sources contains pollutants and suspended sediment, which affects water quality. Domesticated hatchery fish can affect the genetic integrity and fitness of wild stocks, and fishing pressure on wild stocks can increase during years of high hatchery production. Habitat restoration projects can temporarily cause disturbance and increase suspended sediment in waterways, but ultimately may increase habitat abundance and complexity, stabilize channels and streambanks, increase spawning gravels,

decrease sedimentation, and increase shade and cover for salmonids. Scientific research can lead to harm, harassment, and death of listed salmonids, but knowledge gained from scientific research may lead to improved management of listed DPSs, increased population sizes, and consequently increased likelihood of survival and recovery.

IV. ENVIRONMENTAL BASELINE

A. Status of the Species and Critical Habitat in the Action Area

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species within the action area. The environmental baseline “includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process” (50 CFR 402.02). Factors that may currently limit steelhead populations in the Lower Mokelumne River include impedance of passage, high water temperatures, predation, reduced quality and availability of habitat. During dry years, EBMUD traps outmigrating fish at Woodbridge Dam and transports them by truck for release into the Delta (*i.e.*, specifically at Rio Vista in the Sacramento River) with the intent of improving smolt survival and subsequent adult returns.

The MRH steelhead program is not part of the CV steelhead DPS, due to its history of broodstock supplementation with Nimbus Hatchery north coast-origin Eel River stock. The out-of-basin genetic influence introgressed with the native Mokelumne River population (Nielsen 1997). Diversity considerations for the Mokelumne River steelhead were of significant concern in the 2005 status evaluation of CV steelhead. Available data indicated that the monotonic decline in total abundance and in the proportion of wild fish in the CV steelhead DPS was continuing. Other major concerns included the major loss of historical spawning areas above impassable dams, as the lack of steelhead-specific status monitoring, and the significant production of non-local steelhead by the Mokelumne River Hatchery. Dams reduce the scope for expression of the anadromous life history form, and prevent the exchange of migrants among resident populations, a process presumably mediated by anadromous fish (Good *et al.* 2005). Historically, at least two populations of steelhead inhabited the Mokelumne River watershed: the North Fork, and Sutter Creek mainstem (Lindley *et al.* 2006).

B. Factors Affecting the Species and Habitat in the Action Area

1. Barriers and Water Diversions

Since the late 1800s, dams constructed on the Mokelumne River have impeded or blocked anadromous salmonids from reaching all or a portion of their historical spawning areas. Woodbridge Dam was constructed in 1910, Pardee Dam in 1928, and Camanche Dam in 1964. Camanche Dam limits the current upstream extent of CV steelhead and CV fall-run Chinook salmon in the Mokelumne River. The first fish ladder at Woodbridge Dam was built in 1925.

The ladder was poorly designed and failed to provide suitable passage conditions for salmon and steelhead. A more effective fish ladder was constructed in 1948 but was then washed out during a flood in 1950. The existing fish ladders were constructed in 1955, and provided inadequate passage for Chinook salmon and steelhead. It had been hypothesized that upstream-migrating adults may be delayed at the dam because of difficulties in finding the entrance to the fish ladder, and that such delays may contribute to decreased spawning success. In 2001, EBMUD constructed a new fish ladder design that successfully attracts Chinook salmon into the hatchery (J. Smith, EBMUD, pers. comm.).

Water diversions reduce survival of emigrating juvenile salmonids through direct losses at unscreened or inadequately screened diversions, and indirect losses resulting from reduced stream flows. Fish screening and salvage efforts at major agricultural diversions have met with variable amounts of success, and many smaller unscreened or inadequately screened diversions continue to operate. Fish losses at diversions can result from physical injury, impingement, entrainment, or predation. Delayed passage, increased stress, and increased vulnerability to predation may contribute to indirect mortality at diversions.

Diversion impacts on anadromous fish depend on diversion timing and magnitude, river discharge levels, fish run, life stage, and other factors. Because emigrating steelhead generally are larger than emigrating Chinook salmon, steelhead may be better able to avoid impacts from diversions (BioSystems 1992).

Historically, downstream passage of juvenile salmon and steelhead in the Lower Mokelumne River has been affected by diversions at the WID diversion canal, the North San Joaquin Water Conservation District pumps, and numerous riparian pumps. The WID diversion canal was unscreened for decades and was considered a major impact to salmon from the Mokelumne River (BioSystems 1992). In 1968, the WID diversion canal was screened by CDFG to prevent further losses of outmigrating salmon and steelhead. Although the screen has been operating since its installation and has kept fish out of the canal, it does not meet current CDFG fish screen criteria for approach velocity and mesh size (BioSystems 1992; CALFED 1998). Observations at the screen had revealed several potential problems, including inefficient fish guidance structures, improper seals at the screen joints, and deficiencies in the configuration of the bypass intake (Vogel 1992).

1. The Lower Mokelumne River Restoration Program

Delays in downstream migration of juveniles may result from reduced water velocities in Lodi Lake, inadequate fish bypass flows at the entrance to the WID diversion canal, which also serve as attractant flows resulting in salmon straying. There is an indication that poor steelhead escapement to the Mokelumne River Hatchery and possibly higher than normal straying rates may be due to insufficient stream flows, stemming from current management of Woodbridge Dam. There also appears to be a predation problem in the lower end of the Woodbridge Dam bypass, as EBMUD screw traps a certain number of fish above Lake Lodi which do not make it to the EBMUD screw trap below Woodbridge Dam.

The Lower Mokelumne River Restoration Program (LMRRP) of the U.S. Bureau of Reclamation (Reclamation) was developed because of the potential fish passage problems cited above. The stated primary goals of this restoration program are to: (1) implement elements of existing resource management plans to substantially increase fall-run Chinook salmon and steelhead populations, (2) enhance critical and limiting aquatic habitats, and, (3) restore riparian ecosystem integrity and diversity. A major component of the restoration program included improvement of fish passage at Woodbridge Dam and the installation of a new fish screen at the WID diversion canal. NMFS completed consultation with Reclamation on these components of the LMRRP in 2002 (NMFS 2002), and improvements were completed in April 2008.

2. Water Temperature

Water temperature is a primary factor limiting natural steelhead production in many Central Valley streams. Although cold water releases occur below some dams, the amount and quality of habitat available for steelhead rearing below these dams is a fraction of what was once available. In addition, cold water releases are not available below many migration barriers, or are only possible where reservoirs are at capacity. Appropriate water temperature regimes below many dams cannot be maintained at levels comparable to temperatures achieved naturally in the upper watersheds that once provided habitat (Jones and Stokes Associates 2000).

Elevated water temperatures in Lodi Lake during the spring outmigration period (*i.e.*, May to June) may further increase losses by increasing the susceptibility of juvenile salmonids to predation. Mark recapture studies conducted in May and June of 1991 to assess smolt mortality in Lodi Lake indicated that the mortality of hatchery smolt releases at three locations along the lower Mokelumne River (Camanche Dam, Bruella Road, and the mouth of the WID diversion canal) increased with increasing water temperatures and diversion flows at the canal (BioSystems 1992). Although further studies are needed to clarify the factors influencing these losses, the results suggested that some of the loss of juvenile outmigrating salmonids between Camanche Dam and Woodbridge Dam may have occurred in Lodi Lake (BioSystems 1992).

3. Flow Releases

Reservoir operations have altered the natural flow regime of Central Valley streams by changing the frequency, magnitude, and timing of flows. These changes potentially affect all steelhead life stages. Changes in the magnitude and timing of reservoir releases can influence the timing of steelhead migration. Relatively early attraction of steelhead into tributaries can be triggered by occasional reservoir releases of cold water or the occurrence of naturally high flows early in the fall. Conversely, low flows and high water temperatures can inhibit or delay migration to spawning areas. Unnatural and/or rapid flow fluctuations downstream of reservoirs can cause dewatering of redds and stranding of juveniles (Jones and Stokes Associates 2000).

Several studies of instream flows conducted in the Sacramento River Basin for Chinook salmon also have been used to develop spawning habitat-discharge relationships for steelhead. These studies found that successful steelhead spawning requires flows that provide appropriate water depths and velocities over suitability of water temperatures and water quality for steelhead spawning (Jones and Stokes Associates 2000).

As rearing steelhead may be present year-round, suitable flows are necessary throughout the year. In many streams, flows and water temperatures are most critical during the summer. The stream reaches that are presently accessible to steelhead often lack the summer habitat conditions needed to sustain juvenile steelhead through their freshwater rearing period. These unsuitable conditions, which are exacerbated by reservoir operations and water diversions that reduce summer flows, and can be particularly severe in drought years (Jones and Stokes Associates 2000), have been observed in the Lower Mokelumne River, just below the Camanche Dam (Jim Smith, EBMUD, pers. comm., 2003).

4. Predation

Infrastructure associated with water diversions, dams, wastewater treatment outfall, and other in-water construction, offer opportunistic refugia for predators that can decimate rearing and outmigrating juvenile salmonids.

Substantial predation on juvenile Chinook salmon by large numbers of striped bass was observed immediately downstream of Woodbridge Dam in 1993, 1998, and 1999 (Michelle Workman and Jim Smith, EBMUD, pers. comm., 2001). Temporary disorientation of smolts exiting the bypass pipe and fish ladder may increase their susceptibility to predation. Although this does not appear to be a persistent problem, recommendations have been made to implement a predator-control program at the dam (Steven Boyd, EBMUD, pers. comm., 1994; Jim Smith, EBMUD, pers. comm., 2001). The recently installed WID fish screen and outflow pipe is intended to facilitate fish passage while minimizing the risk of fish predation; however, there is indication that fish are still vulnerable to predation. The creation of Lodi Lake during the irrigation season significantly reduces water velocities upstream of Woodbridge Dam and may increase the travel time of juvenile salmonids through this river reach, especially during low-flow conditions. These conditions create favorable habitat for predatory fish (e.g., largemouth bass [*Micropterus salmoides*] and pikeminnow [*Ptychocheilus grandis*]) and may increase the exposure of young salmonids to these predators.

5. Hatchery Operations

The Mokelumne River Hatchery (MRH), located below Camanche Dam, is managed by CDFG and funded by EBMUD as mitigation for the construction and operation of Camanche Dam. Past and ongoing practices of transplanting steelhead from other geographic areas or drainages to Central Valley streams for supplementation purposes are recognized as a major threat to the genetic integrity and overall fitness of native steelhead stocks. This threat is particularly acute on rivers where major hatchery programs sustain the bulk of the steelhead production and have relied on non-native stocks to rebuild these runs (e.g., the American River). Consequently, decreased genetic fitness and long-term viability may have contributed to declines in the abundance of steelhead or in the ability of a steelhead population to recover from low abundance levels (Jones and Stokes Associates 2000). MRH has depended upon the Nimbus Hatchery steelhead program to supplement its broodstock; recent genetic evidence confirms that Nimbus Hatchery steelhead cluster with Eel River samples and appears to predominate *O. mykiss* genetics in the American River and exerts a genetic influence in the lower Mokelumne River (Nielsen 1997; NMFS 1998). The Joint Hatchery Review Team (CDFG/NMFS 2001)

recommended that hatchery transfers of Nimbus Hatchery steelhead for supplementation of the MRH steelhead program be suspended. Since then, CDFG has supplemented the MRH stock with egg transfers from the Feather River Hatchery steelhead stock, which is part of the CV steelhead DPS (Nielsen *et al.* 2003, Garza and Pearse 2008).

Hatchery production is associated with other deleterious effects to fish populations. An abundance of hatchery fish may stimulate fishing, which may increase the harvest rates of naturally produced salmon and steelhead. Hatcheries may contribute to the spread of disease among naturally produced fish. In addition, hatcheries may lead to higher adult run sizes that exceed the spawning capacity of the river, and reduce or displace the population of wild fish (Jones and Stokes Associates 2000).

The MRH steelhead program has a history of poor adult escapement back to the hatchery, leading to the assumption of significant residency of hatchery releases. Experimental releases of MRH steelhead have been carried out in an effort to determine a release site having greater assurance of out-migration success and increased adult escapement to the hatchery. Preliminary results indicate that volitional releases satisfy both criteria (Figures 1 and 2).

6. Habitat Restoration

In recent years, efforts have been made to improve the water quality and habitat conditions of the Lower Mokelumne River. These improvements include a hypolimnetic coldwater-pool management strategy at Camanche Reservoir to improve water temperature conditions, a cleanup program of runoff from the Penn Mine, and a spawning gravel enhancement program and study along the upper reaches of the Lower Mokelumne River (CDFG 1991; BioSystems 1992; FERC 1999; MRTAC 2003). EBMUD has documented increased use of these spawning gravels with weekly redd surveys (Mokelumne River Technical Advisory Committee [MRTAC] 2003).

7. Research

CDFG recently completed a study (Zimmerman *et al.* 2008) on the incidence of anadromy in several CV tributaries, of which the Mokelumne River was not part of the sample pool. Otolith microchemistry is an important tool in the study of migratory polyphenism in salmonids (Donohoe *et al.* 2008; Barnett-Johnson *et al.* 2008). The CV Technical Recovery Team [TRT] had determined it necessary to establish the distribution of steelhead and assess the role resident fish play in population maintenance and persistence of *O. mykiss* in order to develop effective recovery actions (Lindley *et al.* 2007). The study analyzed otolith strontium-to-calcium (Sr:Ca) ratios to determine maternal origin (anadromous versus non-anadromous) and migratory history (anadromous versus non-anadromous) of *O. mykiss* collected in tributaries of the Sacramento-San Joaquin River system between 2001 and 2007. Similar to other regions, Central Valley rivers contain both anadromous and nonanadromous (resident) life history forms of rainbow trout (Zimmerman *et al.* 2008).

Study results suggest that the proportional occurrence of steelhead progeny may vary among locations and among years. Deer Creek is dominated by steelhead progeny while the Tuolumne and Stanislaus rivers were dominated by resident rainbow trout progeny. In the Sacramento

River, progeny of steelhead were present in samples of age-1 and age-2 fish but rare in age 3 and older samples. Since steelhead in the Sacramento River predominately smolt at age-2 (Hallock 1989), it is likely that the reduction in the occurrence of steelhead progeny in older ages is a result of smolt emigration. Further work is needed to better assess the contribution of steelhead and rainbow trout to the anadromous population of *O. mykiss* in streams throughout the Central Valley.

V. EFFECTS OF THE ACTION

The purpose of this section is to identify effects on ESA-listed CV steelhead associated with NMFS' issuance of Permit 1414-M1. The effects of the proposed activities on ESA-listed salmonids include those expected to be related to harassment associated with intentional take. Harassment generally leads to stress and other sub-lethal effects and will be caused by observing, capturing, and handling fish. The applicant has proposed some intentional lethal take of steelhead, and also expects that some unintentional mortality may occur during handling or after the fish have been released.

A. Project Specific Effects of the Proposed Action

There are a number of stressors involved in carrying out the LMRFMP, involving fish capture by hand, hook and line, seine, dip net, rotary screw trap, fish ladder trap, fyke trap, drift net, trawling and electrofishing by backpack and boat.

1. Program Effects

Potential capture and handling effects on salmonids are also described, in detail, in the Central Valley Research Opinion (2003). Capture in nets may cause stress from crowding or abrasion. Electrofishing may cause hemorrhages in soft tissues or bone fractures. Stress from handling may result from excessive doses of anesthetic, differences in water temperatures (between the original habitat and the container in which the fish are held), DO₂ conditions, the amount of time that fish are held out of the water, and physical trauma. These effects may be sufficient to cause injury by impairing juvenile growth rates or causing disorientation which may increase the probability of predation. Direct mortality of juveniles and adults may occur from suffocation or excessive abrasion if fish are trapped in a fold of a net, or from excessive exposure to electrical shock.

The effects of capture and handling generally will be short-lived and will not cause more than the expected lethal take described in Table 3. Injurious or lethal take from capture and handling should be minimized by employing accepted techniques (*e.g.*, emptying traps regularly, adhering to NMFS electroshocking guidelines (2000), using wetted hands and nets to handle fish, *etc.*) to minimize stress and ensure fast processing times and gentle handling. In addition, operators of the electrofishing equipment have successfully completed the "Principles and Techniques of Electrofishing" course developed by the U.S. Fish and Wildlife Service. Past work by EBMUD has maintained capture- and handling-related mortalities below one percent of fish capture (MRTAC 2003). Tissue disturbance from tag insertion or fin clipping is expected to be minor

and to heal quickly, and marking and tagging operations will cease if mortality exceeds one percent.

NMFS believes that adverse impacts from intentional capture will be avoided and minimized. Adult CV steelhead are intentionally captured by using the Woodbridge Dam's upper and lower fish ladders as fish traps. Although salmonids may experience some stress or abrasion in the ladder traps due to crowding, the fish traps are expected to minimize stress by providing sufficient flows and oxygen. Overall, the LMRFMP has not resulted in a significant effect at the scale of the DPS because the observed mortality rates have been low (Table 3), and a portion of the steelhead caught have been non-listed MRH fish. Hatchery fish are expected to predominate in the Lower Mokelumne River (NMFS 2003). EBMUD is encouraged to utilize the use of fish killed during sampling and monitoring activities in the microchemistry analysis, to ensure that no unnecessary lethal take of fish occurs.

Table 3. Lower Mokelumne River Fish Monitoring Program *O. mykiss* Take, 2004-2008.

Permit Period	Type of Take	Adult		Young-of-Year		Smolt		Carcass	
		Authorized	Actual	Authorized	Actual	Authorized	Actual	Authorized	Actual
4/2004 - 9/2004	Nonlethal	800	371	600	113	540	56	100	0
	Lethal	5	0	35	0	10	0		
9/2004 - 9/2005	Nonlethal	800	330	600	597	540	45	100	0
	Lethal	5	0	35	6	10	0		
9/2005 - 9/2006	Nonlethal	800	781	600	491	540	56	100	0
	Lethal	5	1	35	1	10	0		
9/2006 - 9/2007	Nonlethal	800	456	600	433	540	156	100	0
	Lethal	5	2	35	4	10	6		
9/2007 - 9/2008	Nonlethal	800	45	600	184	540	5	100	0
	Lethal	5	1	35	1	10	0		

B. Beneficial Effects of Issuing the Permit

There must be an obvious benefit to the species in order to consider authorizing the intentional capture of ESA-listed species and potential removal of those individuals from the populations. The use of ESA-listed species for scientific research is consistent with the purpose of the ESA when the research facilitates recovery of an ESA-listed species. The status reviews for CV steelhead lament the lack of data available for making satisfactory management decisions (Busby *et al.* 1996). The lack of reliable and widespread abundance and trend data is in itself a risk factor for CV steelhead. Access to useful scientific information is essential to implement the ESA adequately. Scientific information assists in the determination on whether a jeopardy threshold is met; or in developing terms and conditions, reasonable and prudent measures, and reasonable and prudent alternatives. Monitoring activities can help NMFS determine if protective actions are assisting in the recovery of CV steelhead.

These studies have broad significance for the Lower Mokelumne River watershed. A research study of the life history of steelhead will allow researchers to continue to gain insight into variation in fish size within and among habitat types. This information can be used to develop a more detailed and conservative research approach in the coming years by determining appropriate sample sizes (both in terms of numbers of individuals and number of habitat units) for future field work. The information gained from these studies can be used to define and prioritize future fisheries research habitat restoration, steelhead recovery programs, and measure the persistence of existing, and possible evolution of future, diversity of *O. mykiss* in the Mokelumne River, to adapt to anthropogenically altered habitats (Gustafson *et al.* 2007). The correlation between ecological and life history diversity is key in shaping different selective regimes that promote adaptive variation in life history traits (Waples *et al.* 2001). Highly managed watersheds with manmade barriers or natural barriers appear to favor the resident *O. mykiss* life history, whereas broad-scale environmental complexity and instability will maintain partial anadromy in adjacent populations; neither migratory type has a long-term fitness advantage (Olsen *et al.* 2006). No where is this more exemplified than in *O. mykiss*. Life history and genetic diversity have endowed *O. mykiss*, with a high degree of ecological adaptability, demonstrated even in transplanted *O. mykiss* that have naturalized to an exotic environment (Rossi *et al.* 2004). The Santa Cruz River in Southern Patagonia supports a self-sustaining population of introduced rainbow trout stock from which is known to have developed an anadromous run.

In order to facilitate the restoration and recovery of ESA-listed salmonids within the action area, scientific research programs directed toward developing a more robust and complete body of information is needed. Permit 1414-M1 is consistent with the prioritized data needs developed by NMFS, and with the goals of the JSA. Information on *O. mykiss* abundance, stage-specific survival, population structure, and genetics are the highest priority data needs for recovery planning. Studies proposed by EBMUD address these data needs and reduces uncertainty in management decisions. In addition, genetic tissue and otolith microchemistry analysis will provide answers to the questions on Mokelumne River predominant *O. mykiss* life history and phylogenetic relationship to other CV *O. mykiss* populations.

C. Affects of the Action on Critical Habitat

The proposed actions are not expected to have any direct or indirect effects on of the primary constituent elements of designated critical habitat for CV steelhead or any other species.

D. Summation of Project Effects

The risks to ESA-listed salmonids of adverse effects from scientific research are reasonably small and acceptable. Despite the fact that fish are harassed and even killed in the course of research, only a small fraction of available habitat is sampled; therefore, only a small proportion of the total population is subject to sampling and the loss to the total population is small (McMichael 1998). NMFS expects that the research, even if the maximum permitted take is reached, will have no more than a negligible adverse effect on the steelhead population with the Lower Mokelumne River or the CV steelhead DPS. Take prohibitions established for CV

steelhead under the 4(d) rule (65 FR 42422) highlight the value of research in the recovery process, acknowledges the paucity of research data, and encourage scientific research. NMFS believes that information derived from EBMUD research studies will make a significant contribution to the body of science on salmonid biology and assist in management decisions that may lead to the conservation and recovery of salmonids.

VI. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR 402.02 as “those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation.” Future Federal actions, including the ongoing operation of dams, hatcheries, fisheries, water withdrawals, and land management activities, will be reviewed through separate section 7 consultation processes and not considered here. Non-Federal actions that require authorization under section 10 of the ESA, and that are not included within the scope of this consultation, will be evaluated in separate section 7 consultations and not considered here.

A general summary of potential cumulative effects that may affect CV steelhead within the action area is included in the Central Valley Research Opinion (NMFS 2003). Future non-Federal actions that may affect the action area include ongoing agriculture activities and continued urbanization related to increased population. Lower Mokelumne River watershed management involves the continued coordination between the primary stakeholders, EBMUD and WID. Agency activities may influence river flow, water temperature, sediment load, water quality and quantity in the Lower Mokelumne River. Indirect cumulative effects in the action area may include an increase in predation on salmonids, an increase in salmonid straying, and a decrease in available salmonid habitat.

VII. INTEGRATION AND SYNTHESIS

NMFS considers how take of listed steelhead in the Mokelumne River incurred by the project will jeopardize the continued existence of the listed CV steelhead DPS, and includes an effects assessment analyzing the risks of the proposed research program. One of the JSA goals is to sustain the long-term viability of the salmon and steelhead fishery while protecting the genetic diversity of naturally producing populations in the lower Mokelumne River. The analyses of the otolith microchemistry and tissues collected from *O. mykiss* in the Mokelumne River and MRH will provide information directly related to *O. mykiss* population dynamics in the river, and to hatchery and river management.

For the 5-year duration of Permit 1414-M1, the total maximum lethal take of CV steelhead is expected to represent a relatively small portion of the population of the DPS and is not expected to alter the size, diversity, or growth rate of the Mokelumne River population. Because the expected lethal and nonlethal annual take of CV steelhead represents a relatively small portion of the Mokelumne River population, and the Mokelumne River population represents a relatively small proportion of the entire CV steelhead DPS, the expected level of adverse effects from

implementation of the proposed research program is not expected to appreciably reduce the likelihood of survival and recovery of the CV steelhead DPS.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of the species, the environmental baseline for the action area, the effects of the proposed issuance of Permit 1414-M1, and the cumulative effects, it is NMFS' biological opinion that the issuance of Permit 1414-M1, as proposed, is not likely to jeopardize the continued existence of CV steelhead, and is not likely to destroy or adversely modify designated critical habitat.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The issuance of Permit 1414-M1 authorizes intentional take of CV steelhead associated with the proposed research activities. The action of issuing research permit 1414-M1 does not anticipate intentional take of endangered species. This opinion does not authorize any taking of a listed species under section 10(a) or immune any actions from the prohibitions of section 9(a) of the ESA.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the issuance of Permit 1414-M1. As provided in §50 CFR 402.16, reinitiating formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded, 2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, 3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this addendum to the Central Valley Research Opinion, or 4) a new species is listed or critical habitat designated that may be affected by the identified action.

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